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Reviews

Instant Notes: Bioinformatics. Westhead DR, Parish JH, Twyman RM. BIOS Scientific Publishers, Oxford, 2002. pp viii + 253. £16.99.

The data explosion in all aspects of the biosciences, including anatomy, means that it is no longer possible to be a professional without knowing some bioinformatics, a subject that we can adequately define as web-based biology. Indeed, it is not even possible to keep abreast of progress without a minimum of bioinformatics know-how. Our younger colleagues pick up the basic skills as undergraduates, almost by osmosis, but the older generation has to read before it can play. One problem here is that bioinformatics is an incoherent field, responsive to demand rather than proceeding from first principles and so lacks a logical structure. This means that any book needs to cover a lot of ground if it is to be useful, and this material will always start with the databases handling the megabases of DNA, EST and protein sequences that emerge from labs all over the world, and then progress to the host of search, matching and analysis tools that mesh with these databases. But bioinformatics also includes phylogenies, molecular structures and database theory as well as databases incorporating genetic resources, gene expression data, the literature, diseases, ecology and just about any aspect of the biosciences to which data can be appended. There is a lot of web-based material to be covered and one assay of this is the size of the database of biological databases (http://www.infobiogen.fr/services/dbcat/) – this currently catalogues more than 500 bioinformatics resources.

There are now several introductory books aimed at helping biologists appreciate all this material, and *Instant Notes: Bioinformatics* is, for what it offers, rather good. Like others in the *Instant Notes* series, it aims to produce a terse summary of the key issues, here, those of molecular bioinformatics. The book is ideal for someone who has a very basic knowledge of bioinformatics and wants to know more about the databases, what they contain and how they are used, without being told anything about programming. The reader will find brief descriptions of a wide variety of databases as well as theoretical topics such as hidden Markov models (the statistical basis of sequence matching), phylogenies, database management systems, annotations and other areas of informatics that some books exclude. The language of bioinformatics is explained clearly and the authors show how the various molecular databases are integrated with their core experimental data in a way that makes logical and intuitive to the reader the steps from experiment to database to analytical tool. For what the book offers, I am glad to have it on my shelf and strongly recommend it.

It is what the book does not offer that makes me withhold unqualified approval. The problem for people such as anatomists whose interests extend beyond molecules is that the authors seem completely unaware that bioinformatics resources are now available to handle cell- and tissue-based data. The absence of this material from the book is regrettable for two reasons. First, the reader is not informed about databases that are both useful and important. Second, the book omits an important aspect of bioinformatics that is illustrated by the problems posed in handling anatomy.

A quick search for *anatomy* + *databases* on Google yields a range of websites that includes the *Digital Anatomist* as well as embryo anatomies for a range of organisms. Apart from their incorporating developmental and adult anatomy, these databases are starting to archive data associated with tissue names, particularly gene-expression data which of course has to be linked to anatomy. One obvious but singularly unhelpful way of doing this, say for a mouse embryo of a given Theiler stage, would be to list all of its constituent tissues in alphabetical order and use each as a tuple (row) in a database table. As the list of tissues in even an E12.5 mouse embryo numbers many hundreds, inputting data and searching for it would be both impractical and counterintuitive.

It would be far easier for users to search for gene expression details if the tissues were incorporated in an anatomical hierarchy (the forelimb contains the forearm, arm and handplate which contains, etc., where 'contains' is a connecting rule). The problem is that relational databases do not easily handle such hierarchies

because of the need for recursive searching (multiple searching within a single table), something that requires programming beyond that incorporated in database management systems. The standard solution therefore is to keep the anatomy hierarchy separate from the database and use tissue-specific IDs to connect them, with the details of course being hidden from the user who only interacts with the system through a graphical user interface.

This hierarchy of anatomical names connected by logical rules is an example of what is known as an ontology (note that the hierarchy describes a complete area of knowledge and is thus unlike a relational database that is designed to hold unlimited amounts of data in tables). Ontologies are becoming increasingly important as they can not only be used to query databases but also be part of the means by which one database can send queries to another (interoperability). There are now many such ontologies (see http://www.geneontology.org/doc/gobo.html) handling a range of topics, many concerned with phenotypes. The most important, however, is the *Gene Ontology* (GO): this enables a user to search for > 90k gene products (mainly proteins) on the basis of an ontology that describes our knowledge of their functions, the processes in which they are involved and their location within cells. This ontology, together with its associated database of gene products, has now been around for some time and really should have been mentioned in the book.

It is the nature of most books that their authors write about the past and present as they see it; unfortunately, by the time that any book on a rapidly evolving topic is published, this is just the past. Bioinformatics, which still seems to be expanding exponentially, is particularly hard to keep up-to-date with so I hope that *Instant Notes: Bioinformatics* runs to a second edition soon. Ideally, this will contain at least two new chapters: the first will consider hierarchies, ontologies and their associated IDs, while the second will discuss interoperability, the way in which queries can be sent automatically from one database to another. Here, the key technologies are XML style sheets used to formulate the request in an interpretable way and ontology IDs that will detail the specifics of the query. This next edition might also touch on graphical databases, curation and data provenance as these are topics that seem to becoming increasingly important. In the meantime, anyone who wants to know the basics of tissue-independent, molecular bioinformatics will find this book well worth reading.

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Human Anatomy: Color Atlas and Text. Edited by J. A. Giosling, P. F. Harris, I. Whitmore and P. L. T. Willan. Mosby, Edinburgh, 2002. Pp. xiv + 377; fully illustrated in colour. £32.99, paperback; ISBN 0 7234 3195 7.

This atlas, now in its fourth edition, has long been a stand-by for those wanting good quality photographs of dissections, with explanatory diagrams. These remain its principal strength. The new edition is just a little larger, which has allowed a slightly larger font. However, the font is also somewhat less black, so that I did not notice a marked improvement in readability. The terminology is updated to comply with the new Terminologica Anatomica as one would expect. New cross-sections – there were very few in the previous edition – are presented as viewed from below in accordance with radiological practice (though if radiological practice was followed strictly they would be referred to as axial sections). The relatively small number of CT and MRI images are a welcome addition as these are one major way in which students will see most anatomy in clinical practice.

A few things that could usefully have been changed have not been. For instance, in the introductory section the dermatome layout of the head and neck is not shown, the cervical nerves are shown only on the rear view and then not extending up far enough onto the head (though this is shown later).

One weak element is the lack of surface projections and surface anatomy – the other major way in which students will later encounter anatomy. There are, of course, other good volumes that deal with this, but a good diagram showing the relationships between parietal pleura, the lobes of the lungs and the ribs would be more immediately memorable than the text – a point amplified by the good illustration of the surface projection of the heart and its valves.

The exam skills section is now entirely MCQ and misses out the type of questions that asks the students to produce some words from memory rather than simply select from options. It is a minor point in the context of the book's main purpose, but one could

argue that patients never present themselves with the choice of five diagnoses neatly written out for selection, and so the variety of question formats used in the previous edition was educationally better.

The 'Clinical skills' case studies remain almost exactly as before, but the 'Observation skills' section using CT and MRI images with a few horizontal sections of wet specimens is to be welcomed and fills a notable gap in the previous edition. Their inclusion in only the thorax, abdomen and head is perhaps understandable in terms of space, but a few MRIs of the limbs and especially the back would have been welcome and clinically relevant. Another gap – the relative lack of correlative radiographs – has not been filled; in the upper limb the only radiograph is of the hand, and in the lower limb two of the foot, the lateral view being rather less well produced than in the earlier edition. It is not at all clear why the MRI of the heart in the previous edition has been exchanged for a CT as the former showed the chambers of the heart to better effect. As before, the dissections go from superficial to deep. This is useful as a guide to dissection but does not help functional understanding as the muscles are dealt with well before the joints on which they act.

Apart from minor layout changes most pages stay almost exactly the same and the book is essentially what the previous editions were – a set of superb colour illustrations of dissections with explanatory diagrams and a straightforward descriptive text. These will be valuable as a source of reference for those without access to good dissections. The changes are welcome, if relatively minor. Although the changes do not keep pace with the way in which students will increasingly be asked to interpret anatomy as they engage in their clinical studies, if the book is used by students to develop their own three-dimensional concept of body structure then it will have served a valuable purpose.

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Introduction to Immunocytochemistry, 3rd edn. By J.M. Polak and S Van Noorden. Bios Scientific Publishers, Oxford, 2003. Pp. 176; paperback; illustrated; ISBD 185996 208 4.

Immunocytochemistry, with its sisters immunohistochemistry and immunofluorescence, is one of the most powerful ways of asking where in an organism a particular molecule is expressed. This book, which considers all three techniques together, is intended as an introduction to the field for newcomers and as a useful reference for more experienced researchers. From the point of view of the *Journal of Anatomy's* readers, the book succeeds in most of its aims, although people who work on plants and fungi, which offer special technical challenges, will feel misled by the general title of the book; it is very heavily biased towards animal and especially mammalian tissues.

The book is divided into two main sections: a series of chapters on the basic principles of immunohistochemistry and a long technical appendix on detailed methods, which are set out so that they can be used as a 'recipe book' at the lab bench. The chapters begin with a consideration of the properties of different types of antibodies (readers are referred to other works if they need details on how to raise their own), and then go on to discuss the comparative methods for fixing, preparing, sectioning and permeabilizing sections. The problems of antigen loss are described, and advice is offered on how they may be 'retrieved' by heat or by limited proteolysis. A chapter then covers alternative methods for labelling antibodies and detecting the labels, and having established the key elements of the staining method, the book goes on to consider essential controls and the most common causes of non-specific staining and lack of specific signal. Experienced researchers are likely to value this section of the book most highly, particularly for the advice it offers on ways to get awkward antibodies and tissues to work properly. Everybody will also value the comprehensive index.

Most of the book is aimed at immunohistochemistry for standard light microscopy, but one chapter is devoted to the special methods used in transmission electron microscopy and the main problems encountered. This would be a good introduction to the topic, but is unlikely to be adequate to lead a complete beginner to successful immuno-em unless he/she is very lucky. The book ends by discussing, *very* briefly, 'advanced' applications such as confocal microscopy and FACS.

The brevity of this last section points to what is the only significant failing of this book from the point of view of researchers – its scope is too restricted for its title, and too centred on using the technique to examine sections of adult human tissues. Other very powerful applications that are common in developmental

anatomy, for example whole-mount immunofluorescence, are mentioned only in passing and no serious advice is given about how to optimize them. Similarly, no attention is given to a very common use of immunohistochemistry – establishing whether two molecules co-localize. The chapter on electron microscopy would be one place to discuss this, with the problems of statistical analysis of antigen location and the effect on accuracy of the length of the antibody complex itself. Recent advances, such as the use of fluorescence resonance energy transfer (FRET) to measure very small separations between molecules, should also merit treatment in the next edition (if only a brief description and a good reference to a more specialized work).

For many readers of this journal, though, whose interests centre on analysis of sectioned mammalian tissues, the book will be completely adequate and can be recommended without hesitation.

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